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Washington Highlights

The Interstate and Foreign Commerce Committee of the House has taken a holiday until sometime during the current month on the bills designed to amend the Natural Gas Act.

Indications are, however, that the Senate Interstate and Foreign Commerce Committee will begin hearings immediately.

The amendments proposed seek to define the authority and responsibilities of the Federal Power Commission and to provide certain formula for the regulation of interstate transmission and sale of gas.

Gas producers throughout the country have openly expressed fears that the FPC was in a mood tending towards Federal regulation of their operations and earnings in the event they sell any produced gas for interstate moving.

All branches of the oil and gas industry, represented by witnesses at the hearings, have been unanimous in their declarations that the Federal agency must be denied by congressional injunction control over gathering and production of gas.

There are increasing signs that FPC officials may be in accord with some reforms prescribed by the natural gas industry. The viewpoint of these officials, however, is that the proper revisions of authority could be achieved adequately by a willing commission, without congressional legislation.

Oil and gas leaders have warned that the national regulation of gas production would also bring about the regulation of oil.

President Truman views with favor a two-year renewal of the Interstate Oil Compact, controlling production in 19 states.

Senator Hatch, Democrat of New Mexico, made this statement following a White House visit. He disclosed that he had asked the President to send the usual message to Congress urging the required ratification of the compact.

California is not a party to the compact, which has been in existence since August, 1937. Its authority covers regulation by the states of production and other field activities of the petroleum industry.

History's greatest production marked the first full year of peacetime operations of the petroleum industry.

Complete figures covering 1946 United States crude oil production showed output at the record high of 1,748,772,000 barrels. This was a rise of 37,669,000 barrels above the wartime peak reached in 1945.

Despite this extraordinary rate of withdrawal of petroleum from underground reserves, proved oil reserves set up a record top on December 31, 1946, of 21,345,138,000. Compared with a year earlier, this astronomical figure was up 267,114,000 barrels.

The Justice Department apparently is sifting Arabian oil deals already under scrutiny by the Senate War Investigating Committee. State Department records touching upon the Saudi-Arabian Oil transactions are reported in the hands of the Justice Department.

James A. Moffett, former Federal official and oil company executive, recently stated before a Senate committee that the Navy paid excessive prices for Arabian oil during the war. The Navy denied the charge.

The Senate has adopted and sent to the White House a compromise bill completing action of legislation outlawing pending and future portal pay suits. It was approved earlier by the House.

The compromise measure was the outgrowth of a month of discussion between Senate and House conferees, a sequel to passage of differing legislation by the two branches of Congress.

President Truman has nominated William E. Warne, 41, of California, to be assistant secretary of the Deparment of Interior, succeeding Warner W. Gardner. Warne is a former California newspaper man.

The Bureau of Internal Revenue reported collections from the Federal tax on gasoline in the March period totaled $27,578,547. This is a gain of approximately 11 per cent compared with the same 1946 month.

Collections from the Federal tax on lubricaing oil showed a slight decrease. They dropped from $4,863,612 in March, 1946, to $4,756,137 in the corresponding month of this year. Transportation of oil pipeline accounted for collections totaling $1,071,890 in March. A year ago collections were $1,190,902.

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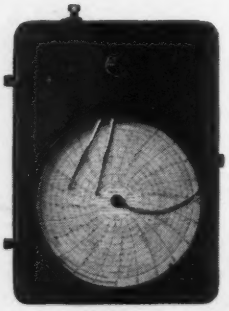

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Technical literature, giving complete data, will be mailed on request. Also information on the Round Case Indicating Flowmeters, Liquid Level and Flow Controllers.

Bentonite and Barytes

Most oil men think of bentonite only as something to thicken a mud; and barytes as something to make it heavier. These two abstracted papers disclose many interesting geological and minings comments about these materials which many will find good reading. . . .Ed.

Definition of Bentonite

A Concise and exact mineralogic definition of bentonite has not yet been established. The name "bentonite" was derived from a clay-like substance found near Fort Benton, Wyoming. This clay was observed to swell to a large volume when wetted with water and from this designation the term bentonite has been assigned to various clays and clay-like substances found in other localities over the country. At the present time a commonly accepted definition of bentonite is a clay-like rock derived from volcanic ash of which the principal constituent is either the mineral montmorillonite or beidellite. A further classification of bentonite has been assigned by the U. S. Bureau of Mines to differentiate between the so-called "swelling" bentonites that swell enormously when wetted with water, and the so-called "sub-bentonite" which refers to bentonites that do not swell more than ordinary plastic clays. More recently investigators have found that the so-called swelling-type bentonite is largely a sodium bentonite; whereas the sub-bentonite is principally calcium bentonite. The reference to sodium and calcium-type bentonite defines the elements in the base exchange position of montmorillonite lattice structure.

Because bentonites are derived from volcanic ash, identification by chemical analysis is of little practical value. It is entirely possible to have a chemical analysis of a typical bentonite similar to that of volcanic ash or tuff. The identification of bentonite in the field is entirely limited to physical properties. Samples are gathered by promising physical properties and sent to the laboratory for evaluations according to the commercial use for which the bentonite is intended. Following is a chemical analysis of several typical Western bentonites together with an analysis of a typical volcanic ash and lava.

Chemical Analysis of Western Bentonites

	*California Bentonite	*Arizona Bentonite	[2]Nevada Perlite
SiO_2	66.94	66.03	65.13
Al_2O_3	24.45	21.17	15.73
Fe_2O_3	3.73	4.04	2.24
FeO	....	....	1.86
CaO	1.29	3.74	3.62
MgO	3.60	5.86	1.42
K_2O	....	....	3.69
Na_2O	....	trace	2.93
H_2O	....	....	2.43

*—Analysis on Volatile Free Basis 1700°F.

[2]—Kemp, James F. Handbook of Rocks. Van Nostrand 1927. p. 25.

Origin and Deposition

Bentonites are formed by the alteration of volcanic ash, such alteration may have occurred as a result of continental or aquatic deposition. In the continental types of deposition the bentonites are limited in quantity and quality and are not of commercial importance within the scope of this thesis.

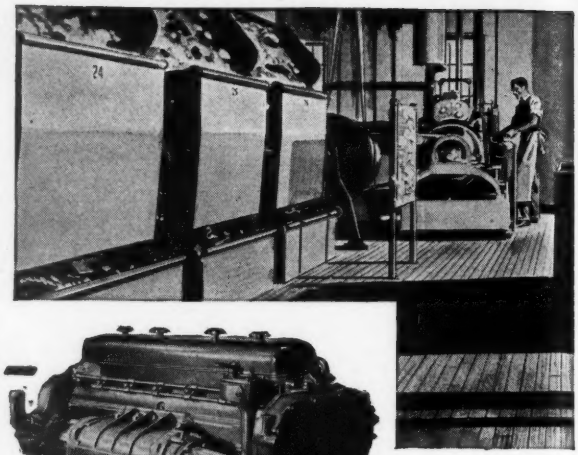
The aquatic type is the most wide spread in occurrence and includes marine, barred basin, and lacustrine classes of deposition.

The marine depositions occurred where volcanic ash fell in estuaries or large shallow embayments of the open sea. Such deposits are typical of those occurrences along the Gulf coastal regions in the United States. Fossil shell remains are common in the bentonite deposits of central Mississippi.

Deposits of barred or semi-closed basins, but related to the open seas, are exemplified by occurrences in eastern Arizona. Ash fell into these basins during Upper Triassic time in sufficient volumes to produce sizable bentonite beds. It is likewise possible the ash falls in the basins were associated with evaporites which salts aided in the alteration of the ash.

The lacustrine depositions include those occurrences where ash fell into ancient continental lakes. Occurrences of this type are found in northern Nevada and Utah. Other occurrences have been noted in eastern California. In one California locality fossil remains of very large

Bentonite imparts good colloidal characteristics to drilling muds; while barytes keeps the mud weighted to the proper density for the control of gas, water and hole-caving.



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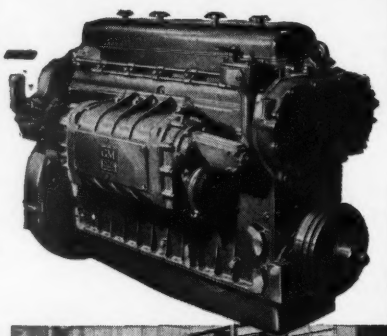

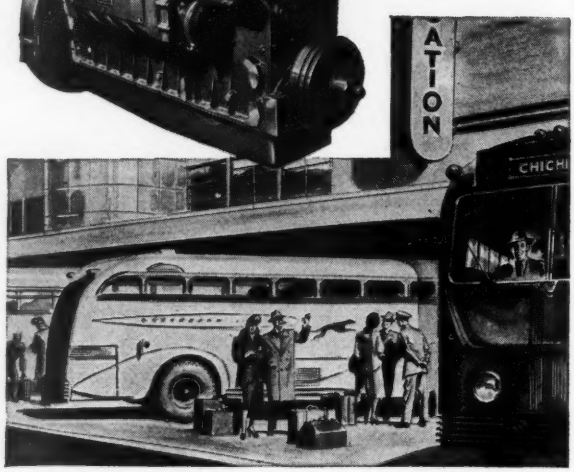

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mammals have been found in the unaltered portions of the bentonite deposits.

The alteration of volcanic ash to bentonite has been fully substantiated by field examinations. Numerous occurrences have been found, notably in eastern Arizona, where a gradual gradation from soft waxy bentonite into hard unaltered ash occur in the same bed over a lateral distance of several hundred feet. In other localities, principally in the Mojave Desert regions of California, this similar occurrence can be noted in the vicinity of faults and folding of some continental volcanic ash beds. Invariably the hard ash is altered to a soft waxy bentonite adjacent to the fault plains and at the apex of sharp folds.

General Geology

Most commercial bentonite deposits occur in flat-lying sedimentary beds. The ash falls, which cause the deposits of bentonite, extend over large areas. Typical examples of this wide spread deposition are the bentonite beds associated with sediments along the Gulf Coast and commercial deposits of bentonite have been found in various localities from western Alabama through Mississippi, Louisiana and Texas to the Rio Grande. The important commercial deposits of bentonite are usually associated with sand, sandstone and limestone. Existing commercial deposits along the Gulf Coast are thought to be outlyers which are erosion remnants, such outlyers have existed because of relatively hard formations above the bentonite beds. Mississippi bentonites occur under beds of limestone and sandy clay; however, in localities where the limestone has been eroded, bentonite still remains without the overlying limestone and such deposits are amenable to strip mining methods. Typical overburden above commercial bentonite deposits consists of sand and unconsolidated sandstone containing some volcanic ash and glass shards. This type of overburden is representative of commercial deposits in eastern Arizona and southwestern California.

The most common diluent in bentonite occurrences is that of sand and lime. The lime usually occurs as gypsum in nodules or veinlets. In the arid regions of the south and southwest, gypsum contamination is quite noticeable particularly in areas where the overburden is shallow.

Description of Barite

Of widespread occurrence in the United States, barium sulphate is relatively soft (hardness 2.5-3.5), inert, heavy (specific gravity 4.5). and is also called "barytes" (sometimes pronounced "bear-i-tease"), "heavy spar" and "tiff". It occurs with granular and earthy structure but usually has coarse, orthohombic crystallization. It is commonly white, and although it occurs in various shades of red, yellow, and gray, it always gives a white streak and can be scratched by the ordinary prospecting pick. Its softness and weight are usually sufficient to establish field identification. Another aid is the "rotten egg" odor of H_2S which sometimes emanates from freshly fractured surfaces.

Barite can be readily distinguished from two other minerals which have somewhat similar occurrences and characteristics. The relatively rare celestite, strontium sulphate, has a specific gravity slightly less than 4.00 and gives a distinctively crimson color in a flame test. The very rare witherite, barium carbonate, has a specific gravity of 4.3 but it readily effervesces with dilute hydrochloric acid.

All known commercially important barite deposits in the United States occur as replacements or cavity fillings in schists, shales, dolomites and quartzites, or as residual deposits from such formations. In Georgia, Tennessee, North Carolina, and Missouri high grade barite is recovered as fragments from residual clays covering quartzites and dolomites. In Arkansas, Nevada, and California barite, usually of lower grade, is mined from replacement deposits. These seven states contributed the entire production reported by the U. S. Bureau of Mines for 1945 as follows:

Crude Barite Sold or Used By Producers In 1945

Arkansas	260,660	short tons
Missouri	225,467	short tons
Georgia	110,393	short tons
Tennessee	32,812	short tons
Nevada	28,919	short tons
Other States	37,811	short tons
Total	696,062	short tons

"Other States" included only California and North Carolina. Such a large part of this undistributed production came from California that that state probably outranked both Nevada and Tennessee. For the second consecutive year Arkansas was the leading producing state, particularly worthy of note because there was no commercial production of barite in that state prior to 1941 and because the entire production of Arkansas has come from one large deposit which is being operated by two companies.

Consumption

The 1945 consumption as reported by the U. S. Bureau of Mines was:

	482,442	tons as ground barite
	139,228	tons in making lithopone
and	99,173	tons in producing barium chemicals
Total	720,903	tons

The Bureau further reported that 87% of the ground barite (58% of all barite) was used as weighting material for oil well drilling muds. The use of ground barite for this purpose has accounted for most of the increased production in recent years. The tonnage used in oil wells in 1945 was just about twice the tonnage of ground barite consumed for all purposes in 1943. Other uses in 1945 were in manufacturing the following commodities: glass, 6%; paint, 4%; rubber, 2% and undistributed, 1%.

Specifications

Specifications for most of the ground barite used in oil wells are 95% minus 324 mesh, 4.30 specific gravity, and low mud viscosities. California production usually has slightly lower specific gravity than ground barite from Arkansas, Missouri, and Georgia, but the other requirements are the same. Ground barite is usually sold in carload lots, packed in 100-pound net weight, 4-ply, paper bags.

Missouri Barite

Mining methods and treatment in the southeast are similar to those employed in Missouri, the second largest producing state. The industry in Missouri is fairly well concentrated in Washington County, southwest of St. Louis. Here the barite occurs as fragments with chert and quartz in residual clay

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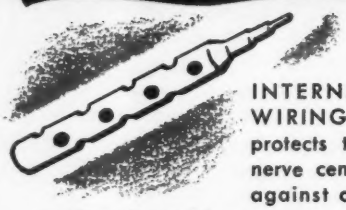
PROVIDE EXTRA PROTECTION ON EVERY JOB

POWDER CARTRIDGE

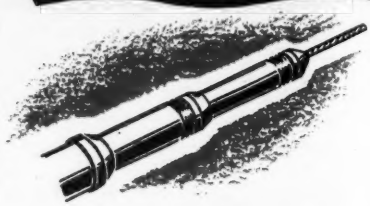
POWDER — in individual cartridges, its safest possible form — absolute protection from mechanical difficulties within the well, no loose powder exposed on the job.

GUN - BODY



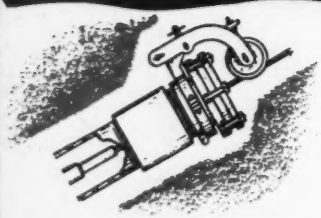
INTERNAL WIRING — protects the nerve center against operational accidents — assures against misfires or twin firing through electrical shorts caused by abrasion or possible electrolytic action of well fluid.

PULL-OUT CABLE HEAD



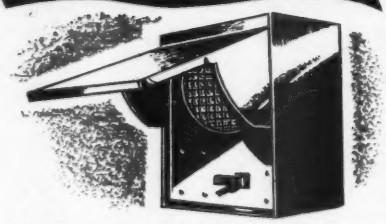
PULL-OUT CABLE HEAD — releases the gun at predetermined tension to avoid expensive wire line fishing jobs, leaves a clean fish.

BLOWOUT PREVENTER



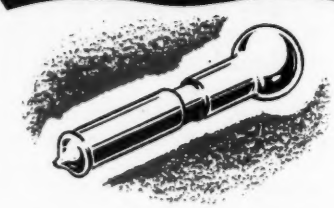
BLOWOUT PREVENTER — permits operations to be completed against pressures. Well is controlled at all times.

RIG SPEAKER



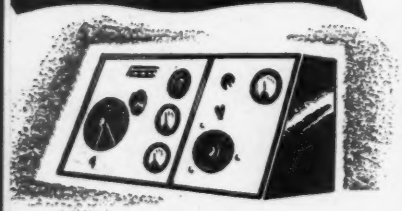
TWO-WAY COMMUNICATION — permits Lane-Wells operator, in truck, and rig man to be in contact at all times.

SAFETY SWITCH



SAFETY SWITCH — on Rig Floor — protects the rig man and crew while the gun is out of the hole.

CONTROL PANEL



CONTROL PANEL — carries four independent switches that must be operated in the proper sequence before the gun is fired.

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deposits which have weathered from dolomites.

The clay is dumped into a hopper or "bull pen" where it is hit with hydraulic water jets and washed onto stationary or rotating rail grizzlies. Some sorting is usually done at this point. Unbroken lumps of clay and waste rock are thrown aside and large pieces of barite are hammered through the rails, usually set at about 4 inches. The slurried material then passes through double log washers where the dirt and clay are removed and overflowed to mud ponds. The log discharges washed "ore" and waste rock to trommel screens or picking belts. Some further sorting is usually done here and at some washers coarse galena is hand picked from the belts. Trommel oversize, about ⅜", is crushed and all the material is jigged to make a high grade concentrate.

The jigged material may be shipped directly to consumers or it may be sold to another producer who maintains a grinding plant and also blends and segregates the jigged tiff from several washers to meet exacting consumer specifications for "chemical grades."

No additional concentrating is done at the grinding plants except that which occurs in dewatering tanks after the material is ground in ball mills to 95% minus 325. The ground barite is dried on rotary steam film driers and then packed in 100-pound bags for carload shipments.

Arkansas Barite

Magnet Cove, Arkansas, is now the most productive barite district in the United States. Present production comes from one large deposit near Malvern in Hot Springs County. Two producers are working opposite ends of the deposit which occurs in a large synclinal fold, known locally as the Chamberlain syncline.

Nevada Barite

At present no ground barite is produced in Nevada, although several producers are conducting mining operations in that state and shipping into California for further processing. Most of the barite activity in Nevada is centered around Battle Mountain, east to Argenta and west of Golconda, although there is a small amount of production farther south from near Tonopah. Several producers hold extensive reserves in northern Nevada and the Battle Mountain area will become of increasing importance within the next few days. Most of the Nevada production comes from surface operations where the barite occurs as limestone replacement deposits, one of which probably contains at least one million tons of high grade ore.

California Barite

In Califronia most of the 1945 production came from a property at El Portal, in Mariposa County. This property is the oldest current producer in the state and has for many years been the most important underground barite mine in the United States. It was operated more or less continuously between 1910 and 1927, and from the latter date to the present time it has operated consistently as the largest producer west of the Rocky Mountains. The property has also been noted for the only commercial deposit of witherite in the United States. The witherite deposit was depleted several years ago. The barite deposits are about a mile west of El Portal and lie on both sides of the Merced River Canyon. The deposits are lenticular limestone replacements in schists and siliceous limestones.

Arizona Barite

Statistics for 1946 show some ground barite production from Arizona where gravity concentrating methods have been tried at a new plant near Mesa. It is understood that this method has not been completely satisfactory and a change to flotation methods is now contemplated.

Foreign Barite

Large deposits are known to exist in Canada and Mexico and, although our productive capacity is ample for present requirements, several low cost foreign producers are in strategic locations with respect to transportation costs, and in 1945 we imported 56,894 tons of crude barite. Very little ground barite is imported because the domestic industry is partly protected by a duty of $7.50 a ton on this material.

This paper presents the combined abstracts of two A.I.M.M.E. papers: "Prospecting, Developing & Mining Bentonite Deposits", by J. P. Rasor; and "Barite Production in the United States", by A. C. Harding. Both were presented before the Industrial Minerals Division, Fall Meeting, Los Angeles, 1946.

A.I.M.E. Pacific Petroleum Chapter

John McMillan, chairman of the Pacific Petroleum Chapter of the American Institute of Mining and Metallurgical Engineers announced that a series of lectures on reservoir mechanics will be given under the auspices of the Production Technology Committee. The program was arranged and meetings will be conducted by N. Van Wingnen, National Chairman of the Production Technology Committee.

The meetings will be open to all interested engineers and geologists. They will be held in the auditorium of the Ethyl Building, 977 W. 7th Street, Los Angeles, at 7:00 p.m. The complete list of authors, subjects, and dates is shown in the following tabulation.

1. May 26th: Geological and Physical Characteristics of Petroleum Reservoirs—by Dean H. Sheldon and Carrol M. Beeson.
2. June 23rd: Flow of Fluids in Porous Media—by John A. Putnam.
3. July 28th: Thermodynamics of Reservoir Fluids—by C. R. Dodson and R. H. Olds.
4. Aug. 25th: Performance of Naturally Occurring Reservoirs—by Edmund C. Babson.
5. Sept. 22nd: Well Spacing and Well Completion Effects—by Richard H. Smith, Russell F. Wade and R. E. Loeck.
6. Oct. 27th: Primary Pressure Control Methods of Operation—by Milan Arthur.
7. Nov. 27th: Secondary Recovery Methods of Operation—by R. H. Zinszer.
8. Dec. 22nd: Maximum Efficient Rate of Production—by Harold J. Clark.
9. Jan. 26th, 1948: Evaluation of Oil and Gas Reserves—by Carlton Beal.

Tulare Wildcat Drilling Ahead

Superior Oil Co. is drilling at 2586 ft. with McGee No. 18 in Sec. 8-18s-24e in the Goshen area of Tulare County. Location is not far from where the company more than a year ago drilled the Huntley No. 1, a dry hole. In the San Joaquin area, Fresno County, Hackala No. 75 in Sec. 32-15s-17e is prospecting at 7070 ft.

Looking Around

By THE OBSERVER

FAT TANKS AND THIN TANKS AND CRAWLING PIPE LINES

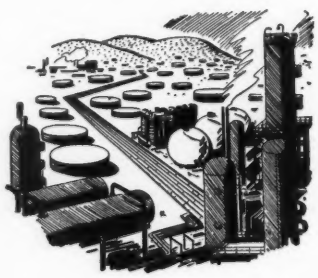
From a hill at Richmond you can see over the many square miles of Standard of California's Richmond Refinery. This hill is within the refinery grounds, and spread out below is a vast panorama of the oil business at work.

What catches your eye first is the number of tanks: fat tanks, thin tanks; tall ones and short ones; black tanks, silver tanks and tanks with black tops and silver bottoms. Within the refinery area there are 1600 of

these tanks, holding a total of 8 million barrels of the various liquids which are a part of the oil industry.

Next you notice the tall chimneys and the slim cylindrical towers over treating plants and cracking units. And then you see the miles upon miles of pipe lines twisting over the ground like endless snakes and carrying millions of barrels of oil and oil products swiftly and safely.

Far across the valley, as you raise your eyes from the scene below you, more silver tanks are glistening through the haze. This is the San Pablo Tank Farm, where the oil that comes from the field is stored. And you



can see the seven giant pipe lines that stretch five miles across the valley to join Richmond Refinery and San Pablo.

And you say to yourself that this oil business is a great industry, one upon which men have lavished much of their imagination and their desire for better living.

Listen to "The Standard Hour" Sunday evenings at 7:30 over N.B.C. Stations.

STANDARD OF CALIFORNIA

Fluidynamics and Thermodynamics of Hydrocarbon Separation Processes

Continued from 2nd April Issue

By Wayne C. Edmister
Hydrocarbon Research, Inc.
115 Broadway, New York

Theoretical Plate and Component Calculations

The task of making combined equilibrium and component material balance calculations for complex hydrocarbon mixtures and multiple stages is so formidable that process engineers have been everlastingly searching for a rapid and accurate shortcut calculation method. Several types of shortcuts have been proposed: (a) absorption and stripping factor method, (b) relative volatility and operability method, (c) empirical correlation of number of plates and quantity of reflux with minimum plates and reflux required, (d) graphical stepwise solution on XY plot for key components with adjusted equilibrium line or alternately modified operating line, etc. In addition there have been improvements in the plate-to-plate calculation procedure. All of these methods do the same thing; namely, solve the equilibrium and component material balance relationships simultaneously for the multiple stages. Some do this more quickly and others more accurately.

Because of uncertainties about plate efficiencies, there is a tendency for some hydrocarbon engineers to depreciate the importance of rapid and accurate component calculations. Even though the plate efficiency may have to be assumed or the number of actual plates determined from plant experience, it is still frequently necessary to make theoretical calculations to determine the component distribution. Also the source of plate efficiencies is plant performance data and an accurate and rapid calculation method is necessary for analysing these data. The general aspects of the different methods are of interest in this paper. For more detailed information about the various theoretical component calculation methods, the reader is referred to the original literature listed at the end of this paper, particularly these references (89, 10, 11, 12, 17, 23, 24, 33, 34, 41, 44, 45, 46, 55, 86, and 87).

A binary approach to the analysis of distillation fundamentals leads to many basic concepts of general applicability. For a binary mixture of "a" and "b", material balance and phase equilibria definitions lead to the following relations—

$$X_a = \frac{1 - K_b}{K_a - K_b}$$

$$Y_a = K_a \frac{(1-K_b)}{(K_a-K_b)}$$

From these two equations the XY equilibrium curve may be constructed from values of K_a and K_b read at the same temperatures. Defining

$$\alpha_{a,b} = \frac{K_a}{K_b}$$

and substituting in either of these equations gives

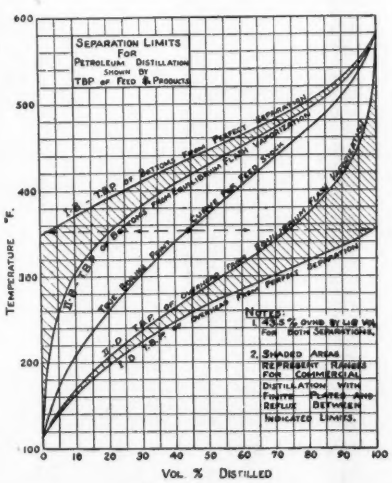


Figure 7

$$\alpha = \frac{Y\,(1-X)}{X\,(1-Y)}$$

Where X and Y apply to the component for which α is evaluated. This equation defines the relative volatility or separation factor for distillation. Evaluated for one equilibrium stage, α would be the relative volatility and evaluated for several stages or a column, α would be the separation factor. This separation factor or relative volatility equation may also be written in the following way

$$Y = \frac{\alpha\, X}{1 + (\alpha - 1)\, X}$$

From this equation it is a simple matter to prepare XY plots for any binary system.

The relative volatility or the separation factor as it is sometimes called permits the use of the lines shown on Figure 2 in making approximate calculations for the distillation of hydrocarbon mixtures. This method, which was suggested by Obryadchikov (61) and Peters (67) and has also been described by Singer, Wilson & Brown (80), is very intriguing and would be a bold and time saving short-cut if it were perfected to a point where it would be practical. Applying an XY graph of this type to a mixture involves approximations and is of limited reliability at the present. With further development work it is possible that a good short-cut method could be derived employing the XY plot.

It is necessary to draw an equilibrium curve for the given mixture using the proper relative volatility, in order to use Figure 2 in making distillation calculations. For a multicomponent mixture this is rather complex to determine directly. It is probably satisfactory to get the value of α from an empirical correlation such as shown on Figure 3. In order to be of much practical value such a correlation would have

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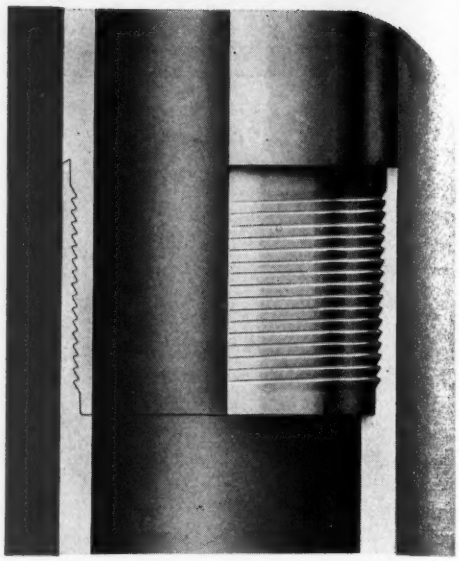

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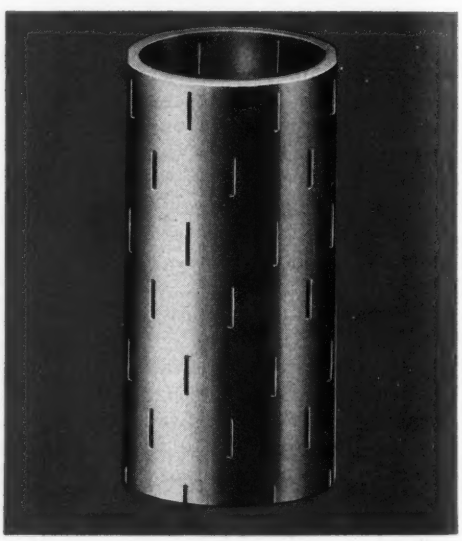

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to include the effects of pressure and the character of the charge. This could be done by flash vaporization runs on many mixtures at different pressures. Another work necessary to perfect a method of this kind would be collecting and analysing plant performance data on petroleum fractionating units.

In addition to this relative vapor relationship, a method should be developed for drawing the operating lines properly so that the graphic steps between the operating and equilibrium lines will give the required number of theoretical stages to carry out the separation. The slope and the intercept of operating lines will be determined by the reflux ratio and the desired sharpness of separation, which might be defined in terms of distillation overlap expressed as a value of XY. The technique suggested by Hengstebeck might be helpful in drawing the operating lines for use on graphs such as Figure 2. The development of such a design method is not within the scope of this article. However, it is of interest to take note of its possibility.

The Gilliland (33) short-cut method, which uses relative volatilities and operabilities, may have some application in developing a method of applying the idea represented on Figure 2. This possibility is suggested because the slope of both operating and equilibrium lines are involved in the application of Figure 2 and because the slopes are also taken into account in the Gilliland method.

There are three graphical methods worthy of mention, namely (a) Sherwood's (77) absorption and stripping design procedure, (b) Jenny's (44) graphical solution for multicomponent fractionation, and (c) Hengstebeck's (40) graphical solution for multicomponent fractionation. For these three XY diagram methods, the equilibrium and operating lines are drawn, with the necessary adjustments, for the key components and the number of equilibrium stages steps off between. The methods employed in correcting the equilibrium or operating lines for the presence of other components is of interest in this discussion. In the Sherwood and

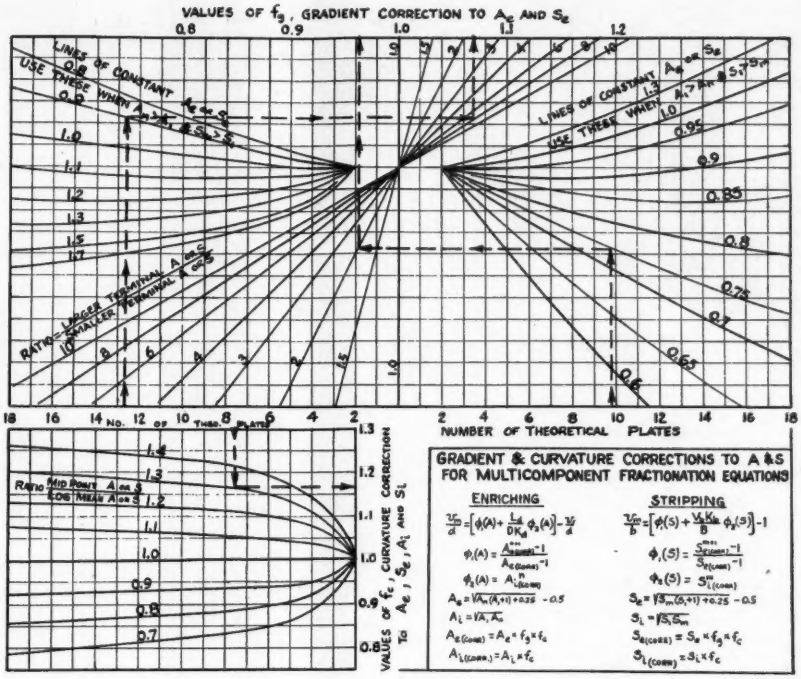
VALUES OF f_g, GRADIENT CORRECTION TO A_c AND S_c
LINES OF CONSTANT A_c OR S_c
USE THESE WHEN $A_c > A_L$ & $S_c > S_L$
LINES OF CONSTANT A_L OR S_L
USE THESE WHEN $A_L > A_c$ & $S_L > S_c$
RATIO: LARGER TERMINAL A_{OR} S / SMALLER TERMINAL A_{OR} S
NUMBER OF THEORETICAL PLATES
RATIO MID POINT A_{OR} S / LOG MEAN A_{OR} S
VALUES OF f_c, A_c, S_c, A_L AND S_L CURVATURE CORRECTION TO
GRADIENT & CURVATURE CORRECTIONS TO A & S FOR MULTICOMPONENT FRACTIONATION EQUATIONS
ENRICHING
STRIPPING

Figure 8

the Jenny methods, the equilibrium lines are constructed by modifying the true equilibrium relationships for the key components in question. Jenny and Cicalese (45) showed how reflux ratio affects the equilibrium line for mixtures. Hengstebeck (40), on the other hand, modifies the operating line. Thus by adjusting either the operating or equilibrium lines sufficiently, binary XY relations are simulated.

A fractionation design procedure of interesting possibilities is the approach used by Brown and Martin (8) and by Gilliland (34), which involved an empirical correlation of the number of plates and the required reflux with minimum plates. These correlations were both developed by making a great many separation calculations for a wide variety of cases and plotting the results. Some of these calculations were for binary systems, for which the McCabe-Thiele method was used, and some were for multicomponent systems, which required a more complex treatment. The form of the correlations and the shape of the curves were determined from the binary system calculations, which constituted the bulk of the work done. It is not surprising that multi-component and binary systems fit the same correlation when handled in a consistent and theoretically sound manner. The application of these methods involves estimating the minimum plates for total reflux and the minimum reflux for infinite plates. These are the limits, between which any practical design conditions must fall. Knowing these limits is an advantage. A disadvantage in this method is that it does not locate the feed plate.

The development of an accurate multicomponent fractionation design method, whether theoretical or empirical, is a complex problem. It is always helpful to have the limits for the separation being studied. As mentioned above, the minimum plates and minimum reflux required for a given reparation represent one set of very useful limits. Another set of limits is illustrated by Figure 7, where the separation limits are defined by the qualities of the overhead and bottoms products for two extreme cases of operation; namely, flash vaporization and perfect separation. On Figure 7, the qualities of the products are represented by the TBP curves, which may be read-

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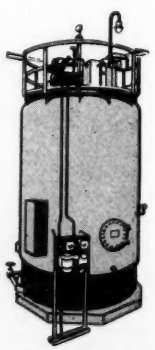

ily compared with the TBP distillation of the feed stock.

In both extremes the amounts of overhead and bottom products are the same, i. e. 43.5 vol % and 56.5 vol %, respectively. In Case I, the split is perfect, the only overlapping being the slight amount that might be caused by the component at the cut point being divided between overhead and bottoms. This perfect separation would require infinite plates and total reflux. The product distillation is represented by curves ID and IB. These curves are obtained directly from the TBP curve of the feed by simply spreading the points to the desired volume per cent scale. Case II, on the other hand, represents the other extreme that would be obtained by flash vaporization of the charge stock with no reflux and no plates. The qualities of the overhead and bottoms products in this case are given by the TBP distillation curves, II D and II B, which are obtained by making empirical or component type equilibrium flash vaporization calculations and plotting.

The shaded area between these limits represents the range of operation for a feasible installation of equipment operated at a commercial reflux ratio. The location of the commercially obtainable distillation curves between these two limits is determined by the number of plates and the reflux ratio in some manner yet to be established. It appears entirely feasible that an empirical method could be devised for locating these lines. This would be a very useful method, which would be applicable to fractionation calculations made in terms of components or in terms of distillation curves. In this connection it should be pointed out that only TBP distillation curves may be used in this way. There are too many irregularities in the ASTM curves.

Such a method would involve making one equilibrium flash vaporization calculation on the charge and then going from this and the perfect separation case to the desired separation. This amounts to multiplying the flash vaporization from one to the total number of stages, such as illustrated on Figure 9. This

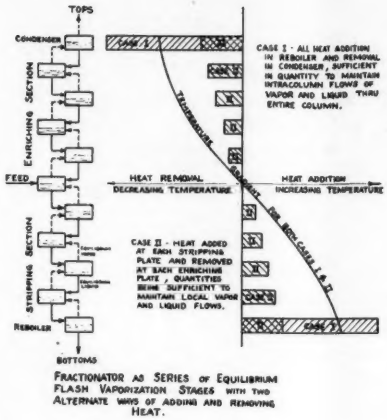
TOPS
CONDENSER
ENRICHING SECTION
FEED
STRIPPING SECTION
REBOILER
BOTTOMS
CASE I - ALL HEAT ADDITION IN REBOILER AND REMOVAL IN CONDENSER, SUFFICIENT IN QUANTITY TO MAINTAIN INTRACOLUMN FLOWS OF VAPOR AND LIQUID THRU ENTIRE COLUMN.
HEAT REMOVAL DECREASING TEMPERATURE
HEAT ADDITION INCREASING TEMPERATURE
CASE II - HEAT ADDED AT EACH STRIPPING PLATE AND REMOVED AT EACH ENRICHING PLATE, QUANTITIES BEING SUFFICIENT TO MAINTAIN LOCAL VAPOR AND LIQUID FLOWS.
FRACTIONATOR AS SERIES OF EQUILIBRIUM FLASH VAPORIZATION STAGES WITH TWO ALTERNATE WAYS OF ADDING AND REMOVING HEAT.

Figure 9

multiplication could be done individually for each stage by making some assumptions as to the interstage flows to get started. However, such a series of flash calculations would be very laborious.

For many fractionation problems it is necessary to work with components rather than laboratory distillation analysis. All but the most heavy mixtures can theoretically be broken down into components and solved by a component method. The component method of approach is necessary for absorption and stripping away. Since absorption and stripping are not equilibrium processes, the calculation methods are different from those for fractional distillation.

Recently, this author (24) presented a method for making absorption and stripping component calculations which methods use effective absorption and stripping factors, defined as functions of terminal conditions only. The equations for the absorption and stripping methods are listed below.

Absorption Equation:

$$\frac{Y_{n+1}-Y_1}{Y_{n+1}} = \left[1-\frac{L_oX_o}{A^1V_{n+1}Y_{n+1}}\right]\left[\frac{A_e^{n+1}-A_e}{A_e^{n+1}-1}\right]$$

Where

$$A_e = \sqrt{A_n(A^1+1)+0.25} - 0.5$$

$$A^1 = \frac{A_n(A_1+1)}{A_n+1}$$

Subscripts 0, 1, n, and n+1 refer to: lean oil, top plate, bottom plate, and wet gas, respectively. The absorption factor, A=L/VK, is computed for top tray and bottom tray and the effective values computed from expressions given.

This equation gives the fraction of any component absorbed, the first term being the correction for the presence of the volatile components in the lean oil and the second being the Kremser-Brown absorption efficiency for a denuded oil. The equations for stripping are analogous.

The effective absorption and stripping factors are shown as functions of the terminal conditions and independent of the number of stages. Where this simplification is justified the above equations permit very rapid and convenient computations of the component distributions. Where this simplification is not justified, it is necessary to use corrected absorption and stripping factors or even use the values for each stage.

From a casual examination of above equations, it appeared that the absorption and stripping equations could be combined to give a method of computing fractionation similar to the absorption-stripping factor method proposed by Brown et al (9, 10, 11, and 12). This idea did not work out because of the basis of the above equations. Accordingly, new equations were developed (23) especially for multicomponent fractionation. The objective was to develop a method that could be used to compute the composition change for any component across a section of the column with a known number of plates and a known reflux ratio. The equations follow:

Enriching Section

$$\frac{V_m}{d} = \left[\phi_1(A)+\frac{L_d}{DK_d}\phi_2(A)\right] - \frac{V_f}{d}$$

Stripping Section

$$\frac{V_m}{b} = \left[\phi_1(S)+\frac{V_bK_b}{B}\phi_2(S)\right] - 1$$

Feed Plate Mesh

$$\frac{V_m/b}{V_m/d} = \frac{d}{b}$$

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Evaluation of Factor Functions

$$\phi_1(A) = \frac{A_{e(corr)}^{n+1} - 1}{A_{e(corr)} - 1}$$

$$\phi_2(A) = A_{1(corr)}^{n}$$

$$A_e = \sqrt{A_n(A_1+1)+0.25} - 0.5$$

$$A_1 = \sqrt{A_1 A_n}$$

$$A_{e(corr)} = A_e \times f_g \times f_c$$

$$A_{1(corr)} = A_1 \times f_c$$

Equations for the evaluation of the stripping factor functions are analogous. The definitions of terms follow:

v_m=Moles of any component in vapor leaning feed plate
d =Moles of any component in distillate
b =Moles of any component in bottoms
f =Moles of any component in feed
D=Total moles of distillate
B =Total moles of Bottoms
L_d=Total moles of reflux
V_b=Total moles of reboiler vapors
f_g and f_c=gradient and curvature correction factors from Figure 8, as described below.

These equations give the composition change for any component across the stripping and enriching sections and are meshed at the feed plate by a component material balance equation. When using the absorption and stripping factors for each plate for evaluating the functions, the above equations are rigorous and give correct results. However, the use of A and S values for each plate is time consuming and consequently it is desirable to use effective values instead.

The effective values of A and S are obtained from equations and correlations developed in the following manner. First, equations were developed giving the effective values as functions of terminal conditions only and independent of the number of stages. These factors are rigorous for two stages and approximate for more than two stages. The next step in developing a method of estimating effective A and S values was to prepare correction factors to correct for the gradient and the curvature in the A and S versus plate plots. These corrections factors were obtained empirically by computing numerous cases of varying A and S values and then correlating on Figure 8, where an explanation of the application of these corrections is included.

Referring to Figure 8, the upper part of the chart gives values of f_g, the gradient correction to A_e and S_e. This correction factor is a function of the number of the theoretical stages, the value of A_e and S_e and the terminal values of A or S. When the values of A_1 are greater than A_n, the righthand side of the chart is used and when A_n is greater than A_1, the lefthand side of the chart is used. This gradient correction factor chart was designed in such a way as to make one parameter common to the right and left sides.

In the lower lefthand part of this Figure 8 is the curvature correction factor, which is a function of the number of theoretical plates and the ratio of the mid-point value to the log mean value of A or S. The resulting correction is designated as f_c and is to be applied to A_e and A_1 (and also S_e and S_1). The log mean value of A or S is readily obtained from the terminal conditions. However, the middle point value must be estimated from a gradient curve of A or S versus the number of stages. This may readily be done by plotting A or S versus number of plates on semi-log graph paper and estimating a middle point by calculating the liquid and vapor quantities and the temperature from which the equilibrium constants may be obtained.

With these correction factors properly applied, the above component calculations may be applied with satisfactory and accurate results to most any multicomponent fractionation problem. In addition, these correction factors may be employed with the absorption and stripping equations as well. In special cases where even more precise results are required or where the gradients are erratic, the recommended procedure is to estimate the A and S values on each plate and use the series equations for computing the absorption and stripping factor functions. Even this will frequently be more convenient than making the plate to plate calculations in the customary way.

There are numerous other methods of making these component distribution and theoretical plate calculations. All of these methods are based on the same fundamentals; namely, the equilibrium and operating line relationships. It is not within the scope of this paper to discuss these various component calculation methods. The primary feature of distinction between these methods is the starting point or the initial assumptions. In some methods the number of plates and reflux are assumed and then the products computed. In other methods, the procedure is the reverse. The methods of this author are presented because they illustrate the similarity and the differences between the absorption and stripping equations and those for multicomponent fractionation. It is important to recognize these and avoid applying either of these equations where they are not applicable.

Component calculation methods such as described above are used in analyzing plant performance data to obtain plate efficiencies. In addition to plate calculation methods, it is necessary to have phase equilibria and heat content data. In order for the resulting plate efficiencies to be of much value it is necessary that the methods used in analyzing a plant performance data be as precise as possible. It is also important that these same basic data and calculation methods be used in applying the resulting plate efficiencies in design calculations.

The accepted procedure in applying plate efficiencies has always been to apply them to the over all results to determine the number of actual plates required. This is not theoretically sound because the plate efficiencies are a measure of the approach to equilibrium. Each successive stage starts out with a new composition and approaches its equilibrium. Applying an over all plate efficiency at the end makes the assumption that equilibrium is reached in one plus or minus stages, depending upon the plate efficiencies. This simplification is convenient and is strictly accurate only

(*Continued on Page 30*)

With Drilling Contractors

Long Beach to Host Annual Meeting AAODC

Plans for holding the Seventh Annual Meeting of the American Association of Oilwell Drilling Contractors at Long Beach on October 13-15 were officially launched April 22, when at a luncheon at the Pacific Coast Club most of the city officials and the drilling contractors on various arrangements discussed various phases of the coming meeting.

Previous annual meetings have been held at Dallas, Tulsa, Houston, Fort Worth, Oklahoma City, and San Antonio. Long Beach made a strong bid for the 1947 meeting, and promised ample room facilities for every requirement.

The April 22 meeting was called to order by Elmer Decker, who lives at Long Beach. City officials present were: Carl Wirshing, City Manager; W. R. "Frosty" Martin, Chairman of the Harbor Board; Eloi Amar, Harbor Manager; A. Slaight, Chief of Police; David Olmsted, Managing Director of the Municipal Auditorium Convention Department; Bill Clark, Frank Hardesty, and J. R. Rumbaugh, Harbor Department. Also present was Ward Johnson, former Congressman representing the Long Beach Chamber of Commerce.

Karl Kellogg, K. L. Kellogg & Sons; Ralph Marshall, V.-Pres., Drilling & Exploration Co.; Brad Mills, Exec. V.-Pres., AAODC; E. C. "Ned" Brown, Pres., Brown Drilling Co., and Vice-Pres. AAODC.

Albert Baptie, Southern Div. Mgr., Shell Oil Co.; William Clark, Chief Petroleum Engineer, Texas Co.; Ralph Marshall, V.-Pres., Drilling & Exploration Co.; Bruce Robinson, Mgr. Joint Interest Operations, Production Dept., General Petroleum; C. L. Fowler, Fowler Drilling Co.

Oil company representatives present were: Will Reid, President of Hancock Oil Company; Sam Bowlby, Vice-President of Shell Oil Company; R. D. Montgomery and William Travers, Richfield Oil Corp.; Albert Baptie, Shell Oil Company; Warren Johnson and Robert Gentry, Standard Oil Company and Long Beach Oil Development Company; Bruce Robinson, General Petroleum Corporation; and Bill Clark, The Texas Company.

Some of the drilling contractors present were E. C. Brown, Vice-President for California K. L. Kellogg, President of the California Chapter; Ralph W. Marshall, D. H. Graham, E. J. Simonis, C. L. Fowler, A. S. Hayes, J. Reid, Thomas P. Pike, George H. McCarthy and J. E. Pettijohn, all on various committees.

Brad Mills, Executive Vice-President from Dallas, attended and spoke briefly on the value of the coming meeting to the drilling industry.

San Antonio last year set an attendance record, when 650 men and about 150 women registered.

Tentative plans call for a three-day session, beginning on Monday and going through Wednesday. En-

tertainment features will include a barbecue, banquet, and various trips for men and women.

All meetings will be held in the Municipal Auditorium. Room reservations will be handled by a central housing committee.

Total membership in the American Association of Oilwell Drilling Contractors is above 1200. The California Section is one of the strongest, and meets monthly.

The Association now has under way several educational projects including Safety, Accounting, Research, and training of men in practical Mud Control. Some of these programs will be extended to California operations. About 1,000 men already have been given courses in Mud Control.

Ed Simonis, Santa Maria Drilling Co., and Secretary, California Chapter AAODC; Bruce Robinson, Mgr. Joint Interest Operations, Production Dept., General Petroleum; A. S. "Doc" Hayes, Hayes & Sprague Drilling Co.

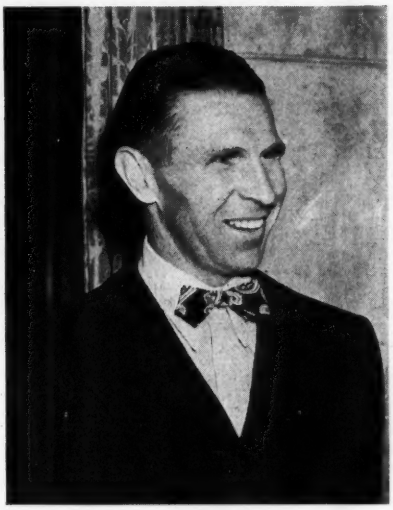
D. H. Grahm, Dunlap & Graham.

California contractors and manufacturers expect a record attendance at the Long Beach meeting.

The following are the committees for the convention:

Central Committee: K. L. Kellogg, E. C. Brown, D. H. Graham, R. W. Marshall, E. J. Simonis, E. C. Reid.

Housing Committee: D. H. Graham.



Tom Pike, President Thomas P. Pike Drilling Company.

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W. R. "Frosty" Martin; E. L. Decker.

Coalinga Venture Starts Swabbing

Sharples Oil Corp. is swabbing from 8000 ft. with its Hyde No. 1 in Sec. 6-19s-16e in the Northeast Coalinga area, after water broke in and called for a couple of squeeze jobs. Bottom is 8900 ft., with plugged back depth 8380 ft. Casing is set at 8378 ft.

Located on an 8000 acre lease, the well was completed and flowed for a time at the rate of 400 barrels of oil and 200,000 cubic ft. of gas daily, before water trouble intervened.

Sharples geological work is in charge of D. M. Evans. Ed Wheeler is petroleum engineer. Richard Crandall assembled the leases and worked out the original geology for the company.

San Diego Try Fishes

North of Oceanside on the Sonja Henie estate, Snell Drilling Co. is fishing drill pipe in its No. 1 test.

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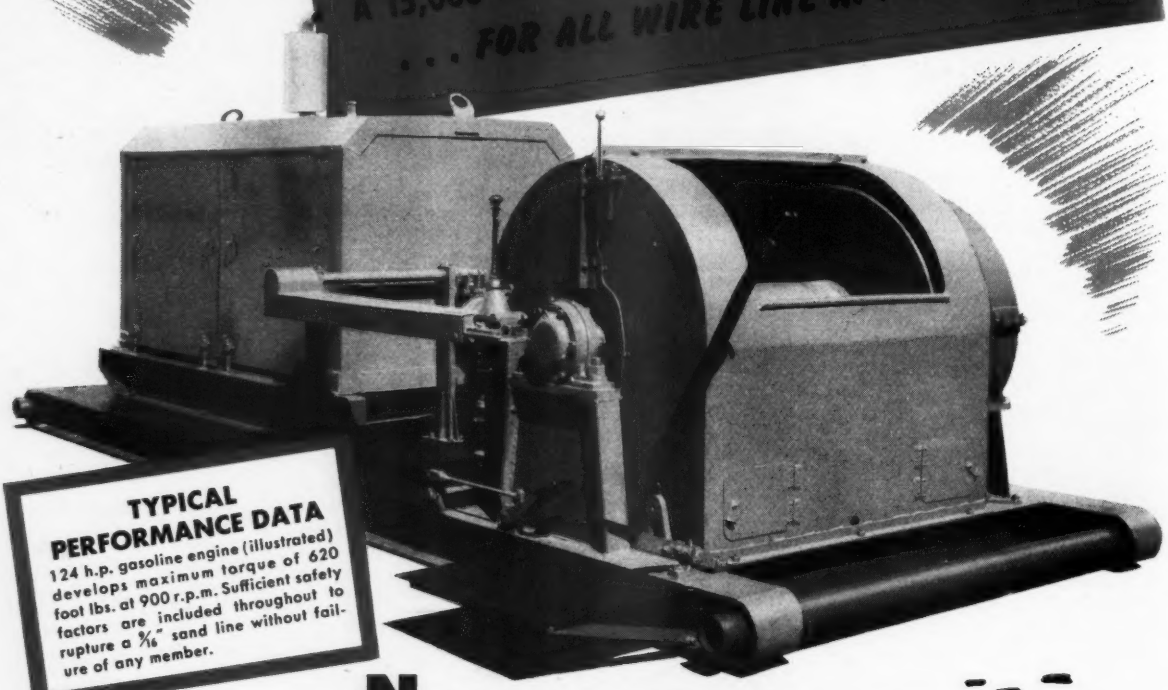

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Field Development

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Los Angeles Basin

Torrance Depth Well Drills On

R. W. (Rocky) Jerman's scheduled deep test of the Torrance field is drilling ahead at 3503 ft. It is known as Torrance No. 1 and located in Sec. 14-4s-14w.

Orange County Tries Active

Orange County is the scene of a number of active test wells.

Morton and Sons' Irvine No. 174-1 in Sec. 10-6s-9w in the El Toro area is drilling at 2211 ft. Irvine No. 55-1 in Block No. 55 on the Irvine Subdivision near Corona Del Mar is making hole at 7362 ft.

In the Placentia area, Tide Water Associated has reached 5462 ft. with its Placentia Comm. No. 12-1 in Sec. 30-3s-9w and is coring ahead. Royalty Service Company's H. B. No. 1 in Sec. 36-3s-10w is prospecting on down at 3750 ft.

Rubicon Oil Company, meantime, has location staked for Wilcox No. 1 in Sec. 6-4n-18w in Santa Ana Canyon. Company engineer is Neal H. Anderson, former California oil umpire and prominent producer.

Amerada Petroleum is drilling at 5520 ft. with Holtz No. 45-7 in Sec. 7-6s-10w in the West Newport area.

Loma Verde Try Rigged

Six miles northwest of the Del Valle field and about three miles north of Halsey Canyon, Shell Oil has rig up for U.S.L. No. 515-29 in Sec. 29-5n-17w in the Loma Verde

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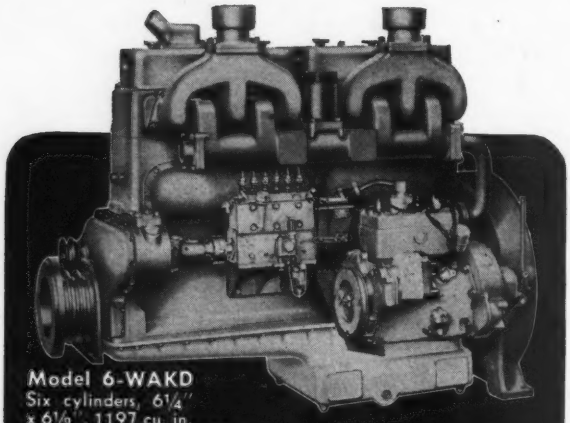
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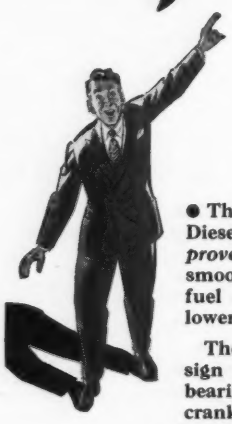

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area. The company's lease block embraces mostly government parcels, along with several private holdings. Some months ago Shell drilled without success on Sec. 27.

In the Athens area, Shell is rigging up Union-Poindexter No. 1 in Sec. 12-3s-14w.

Dominguez Test Prepares To Swab

Union Oil is preparing to swab Hellman No. 58, a deep test in Sec. 27-3s-13w in the Dominguez area. Tubing was run to 11,269 ft. Total depth is 11,330 ft. Santa Fe Drilling Co. is contractor.

Del Valle Try Redrills

Having recovered fish and run and cemented protection string at 5309 ft., Standard of California is now redrilling Boobier No. 1 in Sec. 15-4n-17w in the Del Valle area at 5504 ft. The company's German Comm. No. 1 in Sec. 11-3s-11w is making hole ahead at 9071 ft. Highland Oil Co. has rig up for Esterbrook No. 1 in Sec. 1.

West Newport Test Planned

Barnsdall Oil Co. has made location for Capron-Menvig No. 1, a wildcat test in Sec. 17-6s-10w in the West Newport area. Republic Operators, Inc., has location staked for Newland No. 1 in Sec. 12-6s-11w.

Richfield Well Ready To Pump

Standard of California is ready to pump Kraemer No. 2-35 in the Richfield field, after effecting water shut off at 4217 ft. Total depth is 4607 ft., with casing set at 4235 ft. Bradford Brothers, Inc., No. 3-BB in Sec. 29 is engaged in cleanout operations. Plugged back depth is 3653 ft.

Inglewood Well Flows

Federal Oil Co. has completed Culver City No. 1 in Sec. 7-2s-14w at 8511 ft. for 800 barrels of oil daily through a 36/64-in. bean. Ronald C. Smith and Macco Corp. are redrilling Smith No. 10 at 7537 ft. Basin Oil's City of Inglewood No. 1 in Sec. 28-2s-14w has reached 8000 ft. and drilling on down.

San Joaquin Valley

Miramonte Try Swabs

Pacific Western is swabbing its National Royalties No. 1 in Sec. 5-26s-22e in the Miramonte area of Kern County, with recovery mud showing some gas. Plugged back depth is 12,100 ft., with tubing run to 11,942 ft.

The company is preparing to resume drilling activities in both the Paloma and Riverdale fields. Noel Fee No. 2 is listed for Paloma in Sec. 29-31s-26e. Union Central No. 7 will drill in Sec. 9-17s-19e at Riverdale.

Temblor Try Stands Idle

Cal Oil & Gas Co., Cal No. 1 in Sec. 25-29s-20e in the Temblor area, Kern County, is standing idle in gray sand at 3246 ft.

Bacon Hills Followup Starts

Rigging has begun on Seaboard Oil's followup well to its Seaboard-Bandini No. 3-21 in Sec. 21-28s-20e in the Bacon Hills area of Kern County. It is located approximately 900 ft. southeast of the discovery, which is plugged at 7925 ft. and rigging pump.

The discovery in recent days has been good for a heading flow between 150 and 200 barrels a day. Agitation by the pump may bring about a steady flow. The new job is known as No. 24-21.

Near Panoche Creek in Fresno County, Seaboard's Lillis No. 84-36 in Sec. 36-15s-12e is still a location only.

Pleito Wildcat Gives Up Search

Independent Exploration and Bandini Petroleum have given up as a production failure their first project on a large spread of acreage in the Pleito area not many miles from the Wheeler Ridge field.

The well, known as KCL-A, in Sec. 10-10n-20w, went to a total depth of 5538 feet and in doing so encountered much sand. This sand, however, was bereft of oil showings. The combination of interests may embark upon one or two more tests of the area for a more comprehensive answer of production possibilities there.

Arvin Area Adds Producer

On the Di Giorgio ranch near Arvin, Western Gulf has scored a new pumper with its No. 1 in Sec. 10-31s-29e. Total depth is 6577 ft., with plug at 6463 ft. Initial output was 63 barrels of 24.3 gravity oil a day, cutting 34 per cent.

In the Sand Hills area, the company's S. P. No. 1 in Sec. 25-12s-20w is digging deep at 10,560 ft.

Paloma Field Extension Looms

General Petroleum's Tupman No. 18-6 in Sec. 36-31s-26e, a northeasterly extension test of the Paloma field, appears on the way to success. The project at last reports was coring ahead in oil sand at 12,100 ft., following a formation test of the interval of 11,920-12,025 ft., which reacted with a flow of 631 barrels of 28.9 gravity oil daily. On a prior test of water shut off, with only four ft. of formation open, flow was rated at more than 1000 barrels a day.

Located about one-half mile from established production, the well bears importantly on ground held by the Los Angeles Athletic Club between Tupman No. 18-36 and the field proper, in addition to General Petroleum's holdings.

San Emigdio Try Redrills

Continental Oil Co. bridged at 8144 ft. its K.C.L. No. L-1 in Sec. 11-11n-22w in the San Emigdio area and is ready to redrill. Total depth is 10,424 ft.

McKittrick Active Area

One of the most active areas in San Joaquin Valley is McKittrick.

E. A. Parkford's Parkford-McKittrick No. 1 in Sec. 22-30s-22e is fishing drill pipe stuck at 3760 ft., after going to 7486 ft. in cherty shale. Electric log was run to 7485 ft.

Texas Co. has scored another completion in the area with West Pet Unit One No. 46-29 in Sec. 29-30s-22e. The well was carried to a total depth of 4773 ft. for a current yield of 300 barrels of oil and 3,000,000 cubic ft. of gas daily. Tulare No. 28-29 is coring at 6030 ft. On formation test of the interval of 5893-5931 ft., the well blew gas and salt water. On formation test between 5900 ft. and 5965 ft. recovery was oil and salt water.

Victor Exploration Co. has rig up for No. 1 in Sec. 32-29s-22e.

Kings County Test Coring

Spot coring in Tumey shale at 2510 ft. describes present operations in Guaranty Sales, Inc., Corehole No. 3 in Sec. 8-24s-18e in the Pyramid Hills, Kings County.

Tulare Try Cleans Out

Cleanout operations are proceeding with Frakes Oil Co.'s Toscan No. 1 wildcat in Sec. 28-16s-23e in the Kingsburg area, Tulare County. Bottom is 2930 ft.

Madera Well May Go Deep

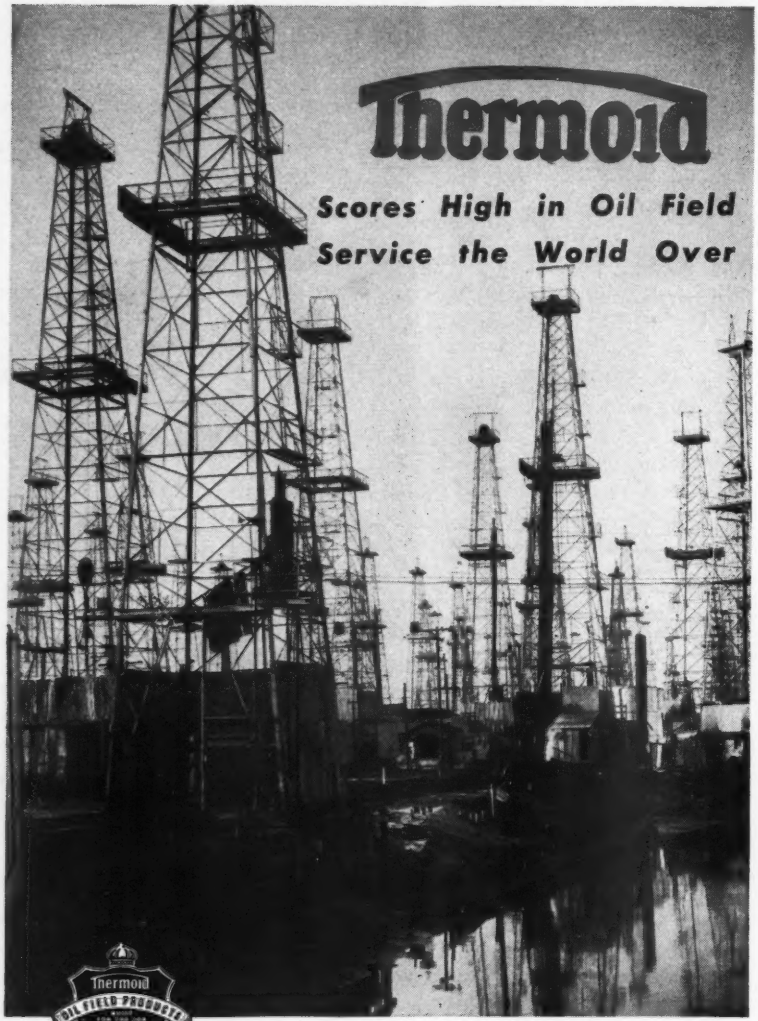
Thomas M. Blake may drill deeper in his Chuck No. 1 explorer in Sec. 28-10s-17e in the Madera area, Madera County. Present bottom is 3922 ft.

Belridge Area Try Fishing

Richfield Oil's Belridge No. B-2 in the North Belridge area is down 7778 ft. and fishing for drill pipe. The company's Berry No. 1 at South Belridge is making hole ahead at 9930 ft. Drill sites are in Sec. 21-27s-20e and 30-28s-21e, respectively.

Coalinga Test Rigs Derrick

On wildcat ground in the Coalinga area, Robert S. Lytle, Operator is rigging derrick for No. 58-34 in Sec. 34-20s-15e, Fresno County.



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Riverside Test Digs

Near Temecula in Riverside County, Palomar Petroleum Co. is drilling at 2406 ft. with Tyrell No. 1 in Sec. 13-8s-1w. Nothing of interest has been reported to present depth.

Newhall-Potrero Project Starting

General Exploration Co. is building rig for Ferguson No. 3 in Sec. 36-4n-17w on ground southeast of Barnsdall's Rancho San Francisco property in the Newhall-Potrero field. Interest in the project is shared with Union Oil Co.

Canoga Park Venture Digs

Vincent F. Stabeck is drilling at 203 ft. with Knapp No. 3 in Sec. 4-1n-17w in the Canoga Park area of Los Angeles County. A real prospect interest sprang some months ago from oil showings in a water well on the Frank Knapp ranch.

Beach City Job Runs Liner

Calumet Gold Mines Co., C. & D. No. 1 in Sec. 10-6s-11w in the tar sand area of the Huntington Beach field is running liner to complete. Total depth is 1857 ft., with casing set at 1795 ft. and top of the main tar zone at 1792 ft.

Del Valle Project Attracts Interest

Considerable attention is being given R. E. Havenstrite Operator, Lincoln No. 15 in Sec. 16-4n-17w in the Del Valle field. The project, which at last reports was drilling on down at 10,804 ft., is credited with a substantial measure of good looking oil sand, somewhat higher in the hole.

No conventional trials have been made of the well. Field men, nevertheless, view the project as promising a new deep zone at Del Valle. The ground under questioning is owned by Lincoln Petroleum Co.

Coastal and Northern District

Montalvo Try Rigs

Seeking to duplicate new oil found by its McGrath No. 2, Standard of California is rigging up to start the drill in McGrath No. 65-3 in Sec. 30-2n-22w near Montalvo, Ventura County.

The new oil was uncovered not far from the mouth of the Santa Clara river, approximately five miles southeast of Ventura.

Piru Creek Test Starts

Bolsa Chica Oil Corp. is rigging derrick for its Bolsa Chica No. 76-32 wildcat test in Sec. 32-5n-18w in the Piru Creek area, Ventura County.

Zaca Area Test Scene

Tide Water Associated Oil's interesting explorer in the Zaca area in Sec. 28-4n-27w, Santa Barbara County, is going ahead at 4013 ft. Nothing of importance has been reported to present depth.

Bardsdale Job Rigging Pump

After flowing by heads, pump is being rigged to W. H. Geis, Geis-Robertson No. 1 in Sec. 12-3n-20w in the Bardsdale area. Total depth is 5887 ft., with casing cemented at 4954 ft.

Arroyo Grande Well Completed

Adams Oil Co. has completed Dollie No. 6 in Sec. 6-32s-13w in the Arroyo Grande field of San Luis Obispo County, pumping 90 barrels of 14.3 gravity oil a day, cutting 5 per cent. Dollie No. 7 is making hole ahead at 1123 ft. Locations are being surveyed for Dollie No. 8, No. 9 and No. 10.

Mesa Test Rigging Up

On the Santa Barbara Mesa, Trans-Oceanic Oil Corp. is rigging M'divani No. 8 deep test in Sec. 28-4n-27w, Santa Barbara County. The company is headed by David M'divani.

Yolo County Try Grading

Ground is being graded for Texas Co.'s Dunnigan Unit No. 2 in Sec. 26-11n-1w in the Dunnigan Hills area, Yolo County. Standard has made location for Campbell Comm. No. 1 in Sec. 18-8n-2e in the Davis area.

King City Well Cased

Having cemented casing at 5702 ft., Shell Oil is preparing to gun perforate for a test above shoe in its Honolulu-Thorup-USL No. 1 in Sec. 4-20s-7e in the King City area, Monterey County. Total depth is 6777 ft.

Ojai Wildcat Starts Drill

An interesting well known as Ojai No. 45 has been spudded in by Richfield Oil in Sec. 13-4n-22w in the Ojai area, Ventura County. Located on the fringe of the old Ojai field, the company with its present job is looking for deeper zone production. The regular producing zone in the field is around 1000 ft.

West Mountain Drilling Center

The West Mountain area is one of the most active drilling centers in Ventura County.

D.D. Feldman, Operator, Richardson Estate No. 3 in Sec. 23-3n-21w is drilling at 2120 ft. Los Nietos Co. & Lucy Smith Battson's recent completion, C. & H. No. 3 in Sec. 23, currently yields 239 barrels of 21 gravity oil and 50,000 cubic ft. of gas.

Ring Oil's S. P. No. 1 in the section, which tested wet at 3750 ft. is standing squeezed. Total depth is 5592 ft., with 7-in. pipe at 3758 ft. Union Oil's Henderson No. 1 is a location.

Oasis Try Gets Ready

Texas Co. is about to start work on its Currel No. 2, an exploratory project in Sec. 4-21s-8e in the Oasis area of Monterey County.

Fillmore Test Works

Washing perforations was the last word from Jahn's Oil Co.'s Good-enough No. 1 in Sec. 18-4n-19w in the Fillmore area, Ventura County. Hole is bottomed at 2210 ft., with casing set at 1240 ft.

Cat Canyon Test Cores

In the Cat Canyon wildcat area, General Petroleum is coring Dominion No. 41-14 in Sec. 14-9n-33w at 3270 ft.

Goleta Explorers Making Progress

Honolulu Oil is drilling its Honolulu-Signal-Macco-State No. 309-1 in Sec. 19-4n-28w in the Goleta area of Santa Barbara County at 1510 ft. No. 308-1 is down 4161 ft. and side-tracking drill pipe fish. Honolulu-Signal-Goleta Comm. No. 1 is prospecting at 6735 ft.

Orcutt Test Drills Ahead

On the Los Flores lease in the Orcutt area, Sunray Oil Corp. is drilling No. 1 in Sec. 4-8n-33w below 5150 ft. Union Oil first uncovered oil in the area during 1903.

Willows Area Job Redrills

General Petroleum, which carried Llano Seco No. 1 in the Willows area to 5456 feet originally, is redrilling the well at 2083 ft. Location falls in Sec. 33-20n-1w, Butte County.

Santa Maria Well Drills

D. S. Fletcher, prominent producer and marketer, is drilling at 3384 ft. with Newlove Comm. No. 101 in Sec. 23-10n-34w in the Santa Maria Valley field. Sunray Oil Corp., meanwhile is grading for No. 6 in Sec. 22. Union Oil has finished at 3142 ft. its Mahoney No. 10 in Sec. 24 for 63 barrels a day. Moretti No. 1-5 in Sec. 24 is making hole at 2557 ft. Union Sugar No. 29 in Sec. 19 is a rig.

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Humboldt County Prospect Idle

Yatura Petroleum, Inc., No. 1 in Sec. 21-1s-2w in the Mattole River Valley, Humboldt County, is standing idle at 2050 ft. The well is credited with encountering several hundred feet of saturated sand stringers. Sand, however, is described as tight.

Oxnard Project Still Working

Equipment is being repaired on O. L. Riley Co.'s Hi Ko No. 1 drilling job in Sec. 5-1n-21w in the Oxnard area. Present depth is 2456 ft. San Miguel Oil Corp., Todd No. 2 in Sec. 6 is a location.

Winters Try Starts

Grading has started for Shell Oil's Szekeres No. 1 in Sec. 19-8n-1e in the Winters area of Solano County. The company recently chalked up as completed its Wagenet No. 2 in the section, flowing 10,650,000 cubic ft. of gas from a plugged depth of 5690 ft.

Elwood Field Wells Drilling

Signal Oil & Gas is drilling State No. 208-6 in Sec. 8-4n-29w in the Elwood field at 3778 ft. No. 129-S-1 is making progress with the drill at 6436 ft. No. 208-5 is pulling tubing, after going on the pump and rods parting. Bottom is 4895 ft.

Brea Field Developing

The development campaign in the Brea field continues at a brisk pace.

Union Oil has completed Narajanal No. 21 at 3878 ft. for 170 barrels daily. No. 22 is drilling a 1570 ft. No. 23 is grading, No. 24 is a foundation and location has been staked for Stearns No. 99. Shell Oil's Fisher No. 9 in Sec. 1-3s-10w is in the completion stage, with bottom at 5135 ft. Birch Oil is building rig for No. 18 in Sec. 2-3s-10w. Brea Canyon Oil Co. is ready to pump No. 50 in Sec. 1 from 1100 ft.

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Round Mountain Extension Sought

Morton & Kohlbush's Alma No. 1 wildcat, two miles west of the Round Mountain field, is bailing with bottom at 2746 ft. Casing is cemented at 2730 ft. Location has been made in the section for Ogier Comm. No. 1.

Cymric Extension Try Drilling Ahead

Seeking a south extension of Cymric production, Miller and York are drilling in shale at 3840 ft. with Merritt No. 1 in Sec. 29-29s-21e. Oil development at this location would benefit Union Oil and General Petroleum, in addition to Miller and York.

Rothschild-Bender Oil Operations, meantime, has spudded Sheep Springs No. 8 in Sec. 17. Standard's No. 72-19w in Sec. 19 is making hole ahead in shale at 2348 ft. It is aimed for the Point of Rocks formation. Top of gray Carneros was placed at 1841 ft.

Independent Exploration's Roco No. 7 in Sec. 18 is drilling ahead for the Point of Rocks formation. Present depth is 2852 ft. The top of the Phacoides was placed at 2744 ft., with cores from 2744 to 2852 ft. showing oil sand, gray sand and shale. Roco No. 8 is standing cemented with casing set at 2324 ft. Hole is bottomed in shale at 2467 ft. Top of Carneros oil sand was placed at 2325 ft. and base at 2444 ft.

Lufkin Builds New Foundry

The new gray iron foundry of the Lufkin Foundry & Machinery Company, Lufkin, Texas, was officially opened April 11 in connection with the Texas Chapter meeting of American Foundrymen's Association. The two-fold occasion attracted foundrymen from Texas and Louisiana to the extent of some 200 registered visitors. Among the out-of-state visitors were S. W. Wood of Minneapolis, president of the Association; William Maloney of Chicago, secretary; Frank Steinebach of Cleveland, Ohio, editor of FOUNDRY magazine David Anderson of National Founders Association, Chicago; Roy Schumacher of Cincinnati; and Howard Nelson of Birmingham, Alabama.

The new foundry, located in the center of a 68-acre tract, has a melting capacity of 160 tons per 8 hours. The main bay with four 10-ton cranes is 60 feet wide and 780 feet long. Two 70 feet cupolas, each capable of handling 20 tons per hour, are used on alternate days.

This foundry is equipped with the most modern handling device for coke, pig iron, scrap, etc. Castings for Lufkin products are produced from complete metallurgically controlled metal.

Los Angeles Try Digs On

Richfield Oil, which recently completed U. P. Unit No. 4 at East Los Angeles as a substantial producer, is drilling steadily ahead below 6050 ft. with Edison No. 2 in Sec. 16-2s-12w in the area.

WAX -

FINE IN CANDLES
A HEADACHE IN OIL LINES

Nobs Wax Solvent will dissolve and remove the most persistent waxes and paraffines from wells lines and traps.

NOBS DEHYDRATING CORPORATION

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Personalities IN THE NEWS

Whaley Again Heads Oil Producers Agency

W. C. Whaley, vice-president of Barnsdall Oil Company and general manager of its California operations, was re-elected president of Oil Producers Agency of California, at its annual meeting yesterday.

W. C. Whaley

Other officers, all re-elected for a second term, are: H. E. Woodworth, Safe Oil Company, first vice-president; R. H. Garrison, Hellman Estate, second vice-president; C. C. Spicer, Republic Petroleum Company, third vice-president; C. A. Johnson, Holly Development Company, fourth vice-president; Rush M. Blodget, Blackfoot Petroleum Co., executive vice president, W. A. Russell, Seaboard Oil Company, secretary-treasurer; Verne Harrell, Bankline Oil Company, assistant secretary-treasurer; Stark Fox, recording secretary.

Mr. Whaley, in addition to his presidency of the Agency, is a director of the American Petroleum Institute, the Independent Petroleum Association of America and the Western Oil and Gas Association. He is also a member of the Wildcat Committee of the latter organization.

Directors elected for the three year term ending April 1950 are: A. E. Bell, Rush M. Blodget, L. A. Cranson, W. H. Geis, Richard A. Grant, R. E. Havenstrite, C. A. Johnson, DeWitt Knox, Cecil M. Rood, Lawrence Vander Leck, Dwight G. Vedder and W. D. Waltman.

In addition to the above, the complete directorate of the Agency includes: W. L. Adkisson, L. L. Aubert, H. A. Bardeen, H. A. Eklund, J. M. Feldman, W. S. Fisher, Earl Fleisher, Robert H. Garrison, O. D. Knight, James H. Lewis, Ralph B. Lloyd, Robert S. Lytle, Maurice A. Machris, C. C. Spicer, D. T. Staples, C. P. Watson, Laurence I. Weill, W. C. Whaley, Leland K. Whittier, Lloyd Williamson, Charles T. Wilson, H. E. Woodworth and Roy W. Young.

Oswald Suter, Horological Engineer, Joins Totco

Oswald Suter, for the past eleven years a member of the Waltham Watch Co. and for the last five years their Chief Engineer has joined the staff of the Technical Oil Tool Tool Corp., Ltd. as Chief Engineer in charge of Manufacturing and Development. This appointment, according to J. B. Wood, president of Totco, brings to the oil industry the services of one of the country's foremost horological engineers.

Mr. Suter received his horological training in Switzerland, graduating in 1923 from the St. Imier Institute of Technology.

Williams Advanced by Axelson

J. C. Axelson, president and general manager of Axelson Manufacturing Co., 6160 S. Boyle Ave., Los Angeles, Calif., announces the appointment of Glynn Williams as

Glynn Williams

chief engineer to succeed E. W. Ostrom whose resignation was effective April 15, 1947.

Williams has been with the Axelson organization since 1934 serving in various capacities in the engineering department, recently being divisional head of aircraft engineering.

Ostrom has served 26 years with the company beginning in 1920 and was promoted to chief engineer in 1934. He is widely known in the petroleum engineering field for his work in standardization and betterment of design of sub surface pumping equipment. For the past several years Ostrum was chairman of the sub committee on the standardization of sub surface pumping equipment and also held membership in several other A.P.I. committees.

Ostrom has contributed greatly to

engineering design and progress through his work and has been a chief contributor to many of the A.P.I. standards publications.

W. C. Trout Passes Away

W. C. Trout, President of the Lufkin Foundry and Machine Company of Lufkin, Texas, died in Lufkin, on April 24th.

Mr. Trout, who was 73 years of age, was one of the most prominent industrialists of the Southwest. In addition to his presidency of the Lufkin Foundry and Machine Company, he was interested in many industries.

The entire city of Lufkin, Texas, payed their respects to his memory, and during the funeral hours, all business suspended.

Mr. Trout was a past President of the Lufkin Chamber of Commerce, a member of the Lions Club, Knight Templars, and the Shriners.

Mr. Trout is survived by his widow, three sons, three sisters, and six grandchildren.

Ziegler Advanced by Kern Oil

Kern Oil Company Limited, of London, has announced the appointment of Fred M. Ziegler as Managing Director of its British West Indies subsidiary, Kern Trinidad Oilfields, Limited.

Mr. Ziegler has long been associated with the California company of Kern Oil Company Limited, and his new duties will call for a division of his time between Trinidad and California.

Frank Morgan, vice president and director of production for Richfield Oil Corp., is back in Los Angeles after a flight by Clipper plane from Sydney, Australia. While in the Antipodes, Morgan visited Papua and New Guinea, as well as Australia.

Consuelo Young, feminine lead in the Mission Play, famed annual production at historic San Gabriel Mission, is the daughter of Rosita Young of Union Oil Co.'s southwest territory marketing department.

Gaylord Heads New Standard Division

Emphasizing a program to augment the development and recovery of oil reserves, California Research Corporation, Standard of California subsidiary, announced the formation of a new division to coordinate and expand the company's oil field research activities.

Heading the division will be E. G. Gaylord, who has been elected vice president and director of the research company.

E. G. Gaylord

Activities of the new branch will embrace laboratory and research services for the various oil field operations of Standard, its subsidiaries and affiliates, including geological, geophysical, drilling, producing and surface processing work. Laboratories for this work will be at La Habra, Calif., where a new structure is now under construction.

Organization of the oil field research division reflects Standard's increasing concern over petroleum reserves. In October the company formed a new exploration department to further the search for oil in the West. Standard also has stressed the need of sound conservation practices.

Formation of the research division, it is planned, will lead to increased knowledge of the characteristics of oil fields and thereby improve prospects for increased recovery from known fields and the discovery of new fields.

Gaylord's experience and background fit in particularly with his new position. A 1911 graduate of the University of California, Gaylord started in the oil business as a roustabout during his college vacations. After ten years in the engineering and geology departments of Pacific Oil Company, he was placed in charge of development in 1921.

Gaylord joined Standard in 1926 at the time of its merger with Pacific Oil. He became chief petroleum engineer, holding that position until his recent appointment. He now serves as chairman of production research committee of American Petroleum Institute and is widely known in the industry.

Ballagh On Foreign Trip

Mr. J. C. Ballagh, Vice President and General Manager of Patterson-Ballagh Division of Byron Jackson Co., departed for New York via Pan-American Air Lines April 15, for a six weeks business trip in England and the Continent.

Jack plans to spend about four weeks in England and will headquarter at the office of H. F. Towler, 9 Cavendish Sq., London W1, Eng. Later he will go to France to plan and discuss future business in the development and use of Oil Field Rubber Specialties, for which Patterson-Ballagh is noted. He is expected to return to the United States the latter part of June.

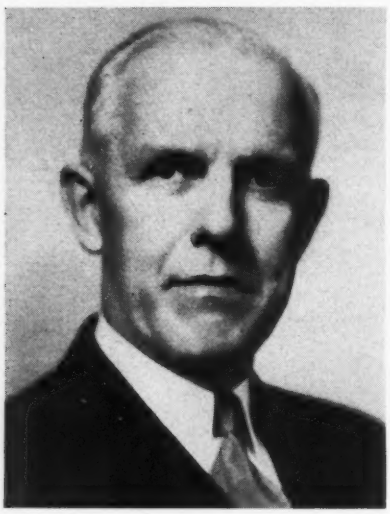
Loyde Metzner, home office geologist for Signal Oil & Gas Co., is editor-manager of the new Pacific Petroleum Geologist, an interesting news letter of the American Association of Petroleum Geologists, Pacific section.

Havoc wrought oil facilities by the Texas City blasts were recently studied by George F. Prussing, technical secretary of Western Oil and Gas Association, and Dr. O. W. Johnson, Standard of California fire protection engineer.

Howard C. Pyle, vice president and manager of the oil department of the Bank of America in Los Angeles announced that the City of the Angels and Tulsa, Okla., have been selected for the 1947 fall meetings of the petroleum division, American Institute of Mining and Metallurgical Engineers.

Perry Elected President of Columbia Steel

J. Lester Perry, Assistant to Benjamin F. Fairless, President of the United States Steel Corporation of Delaware, has been elected President of Columbia Steel Company, U. S. Steel's West Coast subsidiary, succeeding the late William A. Ross, who died in San Francisco on April 19, 1947.



J. Lester Perry

Mr. Perry, who has spent his entire career in the steel industry, began as a cost clerk and rose to the presidency of Carnegie-Illinois Steel Corporation, U. S. Steel's largest steel producing subsidiary. He retired from that post on July 31, 1946, to become Assistant to President Fairless.

Mr. Perry was scheduled to retire from the steel corporation on May 1, but has agreed to serve as President of Columbia until a permanent successor to Mr. Ross is elected. Mr. Perry was a close friend of Mr. Ross during the latter's long association with Columbia.

In assuming the presidency of Columbia, Mr. Perry achieves the unique position of having served as President of three major subsidiaries of United States Steel Corporaiton. A native of Worcester, Mass., Mr. Perry began his business career as a clerk in the Worcester operations of the American Steel and Wire Company, shortly after his graduation from high school in 1899. This was two years before the U. S. Steel Corporation was formed. He served in many departments of the Wire Company, and was appointed Vice President in Charge of Operations in 1933, with headquarters in Cleveland, Ohio. Three years later he was elected President of Tennessee Coal, Iron and Railroad Company, Birmingham, Alabama, U. S. Steel's Southern subsidiary. On January 1, 1938, he became President of Carnegie-Illinois Steel Corporation, with headquarters in Pittsburgh, Pa.

Commenting upon his election as President of Columbia, Mr. Fairless said: "Mr. Perry will bring to our West Coast operations a breadth of experience in the steel industry which is second to none. His career has been marked by outstanding achievement. Under his leadership Carnegie-Illinois broke all existing records in the production of steel for war and peacetime reconversion."

Mr. Perry is a Director of the U. S. Steel Corporation of Delaware, Trustee of the Carnegie Hero Fund Commission, and Trustee of Carnegie Institute of Technology. Until recently he was a Director of the American Iron and Steel Institute.

Prominent in community and civic affairs at Pittsburgh, Pa., Mr. Perry has been actively associated with the Community Fund, United War Fund, American Red Cross, Young Men's Christian Association and the Salvation Army.

Mr. Perry is married and has two children, John L. Perry and Mrs. Elizabeth Perry Walter.

Bob Hall, gauger for Signal Oil & Gas, expects to move in to his new home at Huntington Beach within a few days. Marshall Tinsley, company operator, recently moved in to his new house in the beach city.

One of the Los Angeles oil fraternity's most ardent turf enthusiast is George Ring, president of Ring Oil Co. He has been in attendance at the Hollywood Turf Club harness races whenever business permitted. He derives as much enjoyment from the "jugheads" as the regular running races.

Pehrson Joins Ladish

Ladish Co. of Cudahy, Wisconsin announces the appointment of H. L. Pehrson as Manager of West Coast Sales of Ladish Controlled Quality Forged and Seamless Welding Pipe Fittings with offices at 714 West Olympic Boulevard, Los Angeles 15, Calif.

H. L. Pehrson

Mr. Pehrson, already well known in western piping circles, has been closely associated with the valve and piping business for the past 16 years with the Reading Pratt and Cady Division of American Chain and Cable Co. The last six years of this association were spent as Southern California Representative on petroleum and industrial sales.

George Murray, manager of public relations for Tide Water Associated Oil Co. at Los Angeles, plans to spend all of June vacationing at a ranch in the pine country near Payson, Arizona.

Sam Herndon, who has been identified with California oil development since the early days, is associated with George Atha, geologist and producer, in an exploratory play current in Chavez County, New Mexico.

A. H. Hover, former Los Angeles producer, now makes his headquarters in Artesia, N. M., where he is engaged in drilling for oil in New Mexico hot spots.

THIS LAUGH

OFF!!

"You look all in today, Jim; what's the trouble?"

"Well, I didn't get home until morning and just as I was undressing my wife woke up and said, 'Aren't you getting up pretty early, Jim?' So to avoid an argument I put on my clothes and came to work."

When the name of the plaintiff was called out in court much to everyone's amazement, he stood up in the jury box.

"What are you doing there?" snapped the clerk.

"I was called to serve on the jury," was the meek reply.

"But you must have known you couldn't sit on the jury and try your own case?"

"I suppose not," admitted the plaintiff ruefully. "I did think it was a bit of luck."

A thrifty man went to a lawyer for advice. After the interview the man ran into an acquaintance and told him about it.

"But why spend money on a lawyer?" asked the other. "When you sat in his office, did you see all the law books there? Well, what he told you you could read in those law books."

"You're right," admitted the advice seeker, "but that lawyer—he knows what page it's on."

Father (calling family doctor): Doctor, my son has cholera, and the worst part of it is that he admits he caught it from kissing the housemaid.

Doctor: Oh, well, young people will do thoughtless things.

Father: But, doctor, to be quite frank, I kissed the girl myself.

Doctor: That's too bad.

Father: And to make matters worse, since then I have kissed my wife every morning and evening. I'm afraid that she also will . . .

Doctor (wildly): Oh, my gosh, we'll all have it.

The bigger a man's head gets the easier it is to fill his shoes.

An old colored preacher was warning his parishioners about sin, according to Bennet Cerf in the Saturday Review of Literature. He really got warmed up on his subject that morning and shouted:

"Sin is lak a big dog. Dere's de big dog of pride, and de big dog of envy, and de big dog of gluttony, and finally, brothers, dere's de big dog of sex.

"Now, brothers, you gotta kill dose big dogs afore you're ever gonna get to heaven. I'se done it. I killed de big dog of envy and de big dog of pride, and de big dog of gluttony—and yes, brothers, I killed de big dog of sex!"

A small voice from the rear of the church:

"Brother, are you sure dat las' dog didn't die a nat'chel death?"

"Doc," said the old mountaineer, leading a gangling youth into the presence of the village medico. "I want you should fix up my son-in-law. I shot him in the laig yesterday and lamed him up a mite."

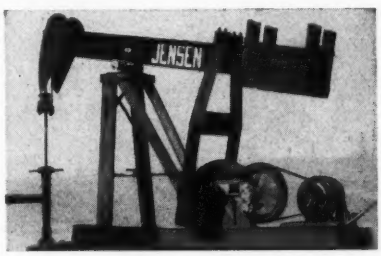
"Tut, tut," clucked the doctor disapprovingly. "Shame on you for shooting your son-in-law."

"Wal, doc," replied the mountaineer, "he warn't my son-in-law when I shot him."

A British delegate to the UN spent some time in New England and was reported to have been shocked by what he called the "open display of sex mindedness in that part of the country." When asked what he meant, he said, "Well, as I drove along your highway, it was 'Soft Shoulder,' then 'Dangerous Curves,' 'Five Gals for $1.00,' 'Try Ethyl,' and finally 'Watch Out for Children'."

A Scot who had worn the same hat for 15 years decided with heavy heart to buy a new one.

Going into the only hat shop in the neighborhood he said: 'Well, here I am again."



Get Tough

When Buying

PUMPING UNITS

Don't buy pumping units as you would chewing gum or cigarettes.

Get tough. Look into specifications and performance figures. Weigh prices, operating costs. Talk to other users. Talk to dealers, too —especially your Jensen dealer. He speaks your language, knows your problems, has reliable figures for your inspection.

He can show you—all factors considered—what has made Jensen units outstanding for 27 years. See him tomorrow.

Stocked by
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3075 Cherry Avenue, Long Beach, Cal.
Phone 481-81

JENSEN
BROTHERS MFG. CO.
14th and Pacific Streets
COFFEYVILLE, KANSAS, U. S. A.
EXPORT OFFICE, 50 Church St.
New York City

(*Continued from Page 15*)

where the plate efficiency is 100%.

The above fractionation equations are used to compute the component distribution for given or assumed operating conditions. It is customary to classify these starting conditions as primary and secondary assumptions. The primary assumptions might be the operating pressure, the number of theoretical stages and the reflux ratio or heat input. The corresponding secondary assumption would be the compositions of the products and the temperature gradient. From this starting point calculations can be made to check and revise the secondary assumptions where necessary and then find as a final product of the work the distribution of the components between the products that will be obtained by distilling the given mixture with the conditions specified by the primary assumptions. The effect of the number of plates, the pressure, and the reflux ratio can be determined by making other primary assumptions and carrying out the calculations in the same manner.

With reference to pressure, the customary procedure is to fix the pressure according to the conditions required for reflux condensation. However, it is desirable to keep the pressure as low as possible because a high pressure increases the temperatures in the column which necessitates supplying heat in the reboiler at a higher temperature level. Another advantage in keeping the pressure low is the fact that the relative volatilities of any two hydrocarbons are higher at low pressure than at high pressures and this in turn makes it much easier to separate the components. It is also desirable to avoid high temperatures in the reboiler where high temperatures have a bad effect on the specifications of the product being produced.

In some absorption type vapor recovery plants reboiled absorbers are employed for deethanizing the rich-oil (see reference 93). For this type of operation the absorber consists of two parts which may be in the same tower. The top part is the absorption section into which lean oil is put at the top and wet gas enters at the bottom. The lower section is the reboiling section where the rich oil is stripped of ethane. This deethanizing is employed in order to lower the pressure required for condensing the recovered hydrocarbons. The process calculations for this operation are rather complex. For the absorption section the above absorption equation may be used, but for the reboiling section it is necessary to use the fractionating stripping equation. The results from these two equations must be meshed at the feed point.

Design by Pilot Plant Methods

For special or new types of separations, it is often necessary to carry out pilot plant studies to obtain the design factors. These pilot plant results are then analysed and interpreted by applying fundamental properties and theoretical methods to the experimental data. This approach has been used in developing hypersorption, azeotropic and extractive distillation, etc. It is sometimes used on special fractional distillation processes, such as the precise fractionation of naphtha to make aviation gasoline base stock components.

Special laboratory equipment is available for this type of work. A drawback of this technique is the large volumes of material and samples that must be handled in order to get sufficient accuracy under steady flow continuous operation. For this reason this design technique is almost limited to a refinery or large laboratory location.

Equilibrium flash vaporization of crude oils under atmospheric and vacuum conditions in a pilot flashing unit, with analyses of the distillates and residues, is always required in the design of crude distillation units, regardless of how much back log of similar data may be available, or how reliable the empirical equilibrium flash vaporization correlations may be. This is particularly true where lube distillate production is involved. Neither empirical nor component methods are adequate in the wax and asphalt regions.

Pilot and commercial plant operations might be used in developing a method of applying the idea represented by Figure 7 to design. Performance data could be used to locate an actual operation and/or design case between the separation limits as defined by Figure 7.

Another example of the empirical method of design was described by Packie (63), who correlated the sharpness of separation, the number of actual plates, and the reflux ratio using data from refinery fractionation units in developing the correlation. This correlation is easy to apply, and would be a worthwhile tool if results from applying it inspired confidence in it, which is not this author's experience. It appears that it is too simple to take into account all the variables. One possible explanation for these results is the fact that Engler distillations are not very reproducible making inconsistencies in these characterizing analyses reflect large discrepancies in the correlation itself.

This is a problem with all empirical methods, however. It emphasizes the desirability of developing an improved method of analysing and characterizing mixtures. In sharply fractionated separations, the ASTM (or Engler) distillation curves of the adjacent products will have a gap between the end point of the lighter and the initial of the next higher boiling fraction. This results from the fact that the Engler distillation is partially differential. The T.B.P. distillation curve, on the other hand, is carried out with a high reflux ratio and with adequate contacting surface so that components present come off in the order of their boiling point. When fractional distillation products are analyzed by the T.B.P. distillation method, they show an overlapping as would be expected because adjacent products contain some of the same components as perfect separation is not possible. The thing that makes the ASTM distillation curves so unpredictable is the fact that they are carried out with an uncertain amount of reflux and with no contacting plates. If it were not for the heat loss and the human error, the ASTM would be a differential distillation curve and might be reproducible.

Hydrocarbon separation by absorption and/or fractional distillation

may be computed by component or empirical methods with reasonable accuracy. For these separation processes, the design methods are sufficiently well developed and backed up by enough operating experience to permit making firm designs without requiring any pilot plant data, except in the case of special problems, such as the precise fractionation of naphtha for the production of aviation gasoline blending component of the preparation of a feed stock for making toluene. In cases like this such sharp separations are involved and such large quantities of feed stock are handled to obtain a relatively low yield that a very careful analysis of the feed stock is necessary to determine the composition of the feed stock. In addition it is frequently necessary to fractionate enough of the feed stock in the pilot plant laboratory to obtain a quantity of the desired product for anti-knock determinations and for experimental evaluation of the product as a starting material for a synthesis operation. If handled properly, this pilot scale feed preparation may also yield information of value about the reflux ratio and number of stages required for the separation.

For such pilot plant operations, a small bubble plate column should be used. This column should be flexible, continuous, adjustable and well instrumented. It should be possible to vary the charge rate and the column should have resistance heaters distributed along the column to compensate for heat losses. With an apparatus of this kind it may be possible to obtain more data on a precise fractionation of a complex mixture in a shorter time, but probably at a higher cost, than could be calculated by the same number of men. In order for this data to be of any value in design, a method of translating these results from the pilot plant scale to commercial scale. Plate efficiencies and column capacities may very easily be different for a small pilot unit. It might even be necessary to run the pilot plant unit at a higher pressure than the commercial unit will run in order to get different relative volatilities and flow characteristics of vapor and liquid as may be required to make the pilot plant results duplicate expected commercial plant performance as nearly as possible. This technique is used in small scale wind tunnel and small scale topographical flood control experiments. It seems entirely feasible that this same general idea might be employed in fractionation experimentation.

The pilot plant step is usually necessary in designing azeotropic and extractive distillation processes. In fact, the need for experimental data is more urgent for solvent processes than for straight fractional distillation. Theoretical and empirical methods of interpreting correlating and applying the pilot plant data are also necessary. The literature on extractive and azeotropic distillation includes articles on the pilot plant and the theoretical aspects of the processes. A few such references are included in the literature list at the end of this article. (3, 4, 20, 21, 22, 52, 58, 69).

Bench scale analyses and pilot plant distillations may be considered as the link between theory and practice. The literature contains several papers on this subject. Fenske (28) is well known for his contributions. Important as this subject is there is no standardization of apparatus or technique, except for the Engler (or ASTM) distillation. Standardization on three laboratory procedures would be desirable. These are: (a) true boiling point analysis, (b) equilibrium flash vaporization, and (c) pilot plant distillation with commercial plant conditions.

Any empirical method of designing hydrocarbon separation processes, whether based on pilot plant or commercial plant performance data, will be no more accurate and reliable than the data on which it is based. For this reason the method of taking the performance data is very important. The testing procedures followed by Gunness (37) and McGiffin (57) are recommended as examples of good technique.

Continued in next or 2nd May Issue

CNGA Annual Frolic Scheduled for June 7th

Entertainment Committee Chairman, Phil W. Mettling, has announced that the California Natural Gasoline Association will hold their June Frolic at the Rio Hondo Country Club on June 7.

Phil W. Mettling

In addition to Chairman Mettling, the entertainment committee consists of R. E. Raasch, Tom Webb, Ed Bishop, and Marion Arnold.

A top notch show will be produced by Walter Trask, featuring the latest M. C. sensation from Broadway, Lionel Kay, formerly three years with Olson & Johnson's "Sons of Fun." Two hours of outstanding entertainment will follow the barbeque dinner.

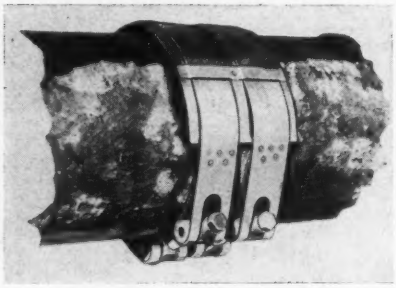
An old fashioned Olio is being planned to allow those who like to sing to display their voices.

The day's festivities will open with the first foursome teeing off in the Blind Bogie at 7 A.M. and continuing with the annual baseball game between the gasoline companies' "Octaners" and the supply companies' "Gassers"; horseshoes, paddle tennis, patika and ping-pong.

Several door prizes will be awarded to those holding the lucky tickets. Every effort is being made to plan something for everyone, so Phil will see to it that the day will be an outstanding one. Come early and stay late.

Marman Products Announce New Clamp

A new line of high pressure pipe leak clamps, withstanding pressures to 1,100 pounds per square inch on corroded pipe without leaking, is announced by Marman Products Co., Inc., 940 W. Redondo Blvd., Inglewood, California.



Designed as permanent repair clamps for high pressure pipe leaks of oil, gas, aromatic fuels, water, etc., these stainless steel clamps weigh up to a maximum of only six pounds, and can be installed by one man. Interesting features of these clamps include extreme high strength and corrosion resistance; laminated Hycar rubber pads which compress into corroded area of pipe when under pressure, while resisting the tendency to cold flow; and a stainless steel patch plate, which slides on clamp band, affording the most advantageous positioning of clamp over leak.

These clamps are being produced to fit all sizes of pipe from 2 to 8 inches. Larger sizes can be made upon request.

Addition of the high pressure pipe leak clamps to the Patch Master and low pressure types, provides a line which covers every need for quick, permanent pipe leak maintenance.

Deliveries can be made in one week from receipt of order.

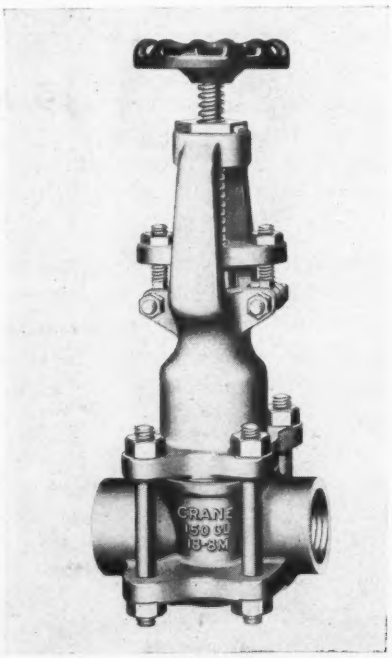
Crane Co. Announces New Plug Gate Valves

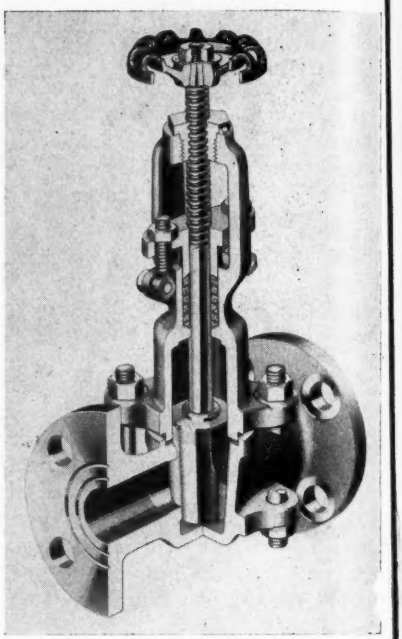
Crane Co., Chicago, announces a new line of corrosion-resistant plug gate valves which are unique in that they combine the advantages of the two most important basic types of valves. The new design provides straight-through flow in the wide-open position as do conventional gate valves, yet it is as suitable for throttling service as conventional globe valves.

According to the manufacturers, extensive tests conducted in the Crane Research Laboratories and in the field have established the following advantages for the plug gate valves:

(1) They offer very little resistance to flow in the wide-open position, having a maximum discharge equal to that of a wedge gate valve and about twice that of a globe valve.

(2) The design permits very close throttling at both high and low velocities.





(3) Resistance to cutting action of the fluid when in a throttled position is equal to that of conventional plug type globe valves.

(4) The valve is not subject to sticking in the closed position, even though it be closed while hot and opened when cold.

(5) There is no tendency to galling, which is so prevalent in alloy wedge gate valves, especially in the small sizes.

Of outside-screw-and-yoke design, the new Crane plug gate valves have bolted bonnet joints and are available with either screwer or flanged ends in sizes from ½ to 2 inches. They are regularly furnished in either 18-8 Mo or Monel metal. For particular corrosive conditions they can also be made in various other alloys to customer's specifications.

Mount Poso Well Planned

Aga Oil Co. is preparing to drill well No. 12 in Sec. 3-27s-28e in the Mount Poso field.